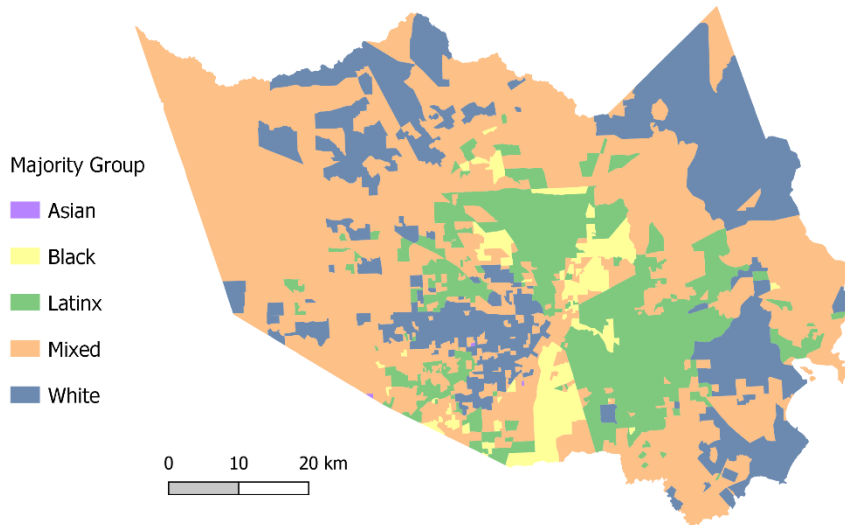


Environmental Justice in Hurricane Harvey's Detritus

By Jorre Dahl

GEOG 120

Majority Race/Ethnicity by Block



FEMA Flood Zone and Actual Flooding

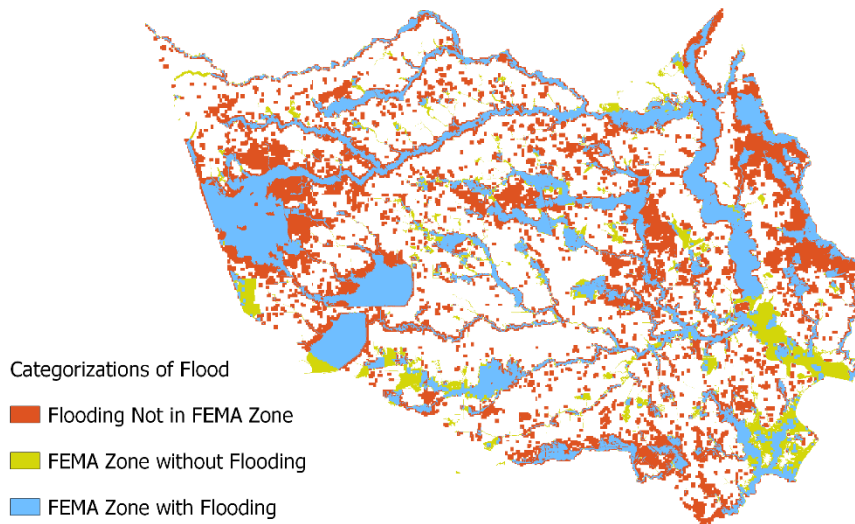
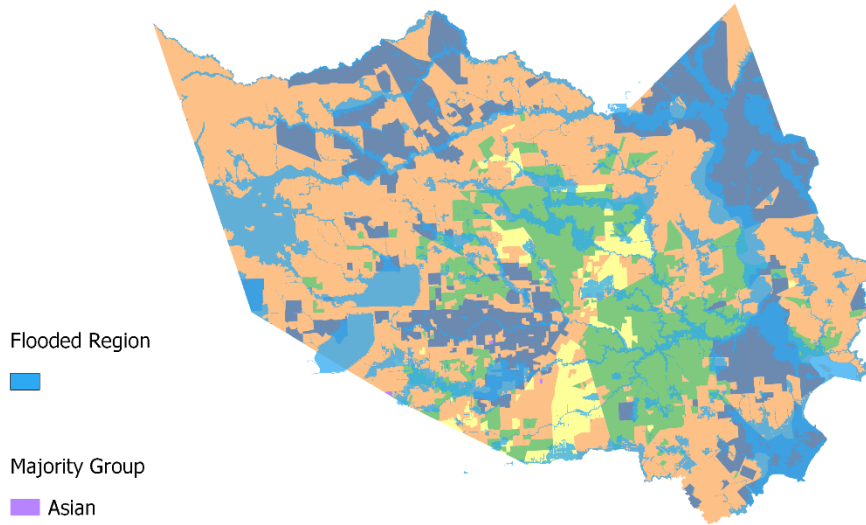


Figure 1: Overview of Study Area

In August, 2017, Harris County, Texas was hit by rains from Hurricane Harvey, which caused flooding that extended past FEMA's flood area predictions from their 100-year flood zone. Here, Majority Groups are spatially clustered close to each other, mostly stemming from a certain range of direction from the Houston city center. This difference in location of where certain racial groups are clustered resulted in disproportionate levels of flooding. Blocks that are predominantly White, Latinx, and Mixed Race were located where most of the flooding occurred. Here, unexpected flooding past the FEMA prediction may disproportionately effect neighborhoods of Latinx majority and Mixed Racial majority.

FEMA Predictions of Flood Area



Actual Flood Area

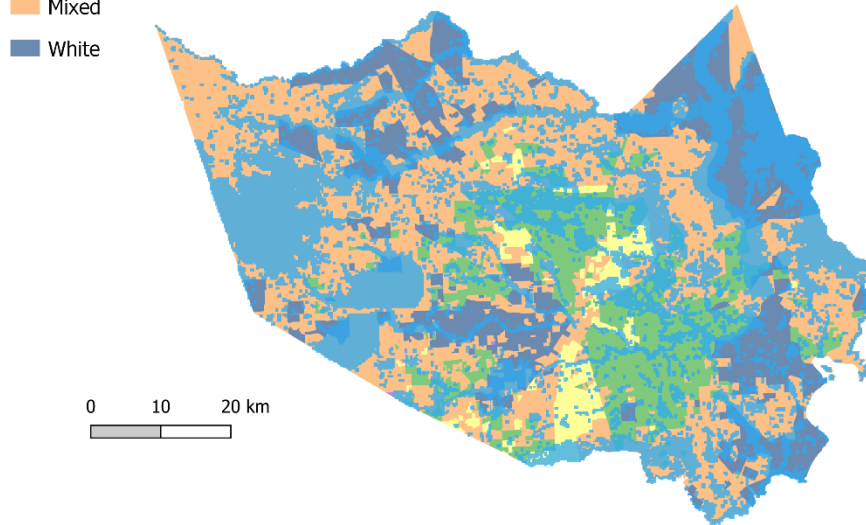


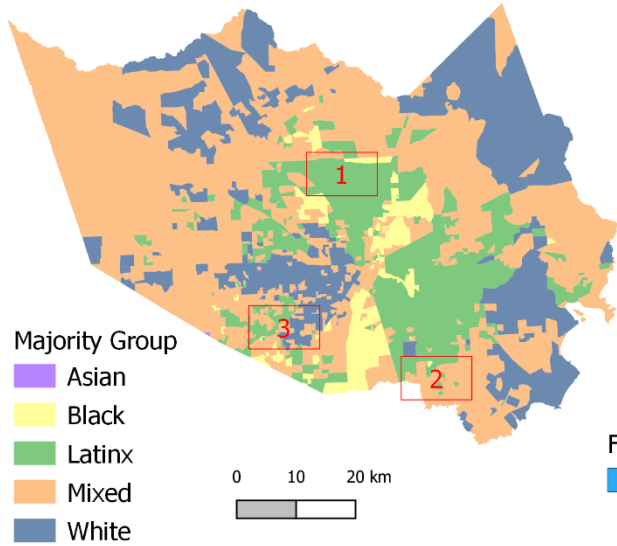
Figure 2: Flood and Flooding Predictions by Racial Group

Figure 2 and Table 1 show discrepancies between FEMA’s prediction and the actual flooding overlaid over the racial/ethnic majorities of Harris County. While white and Mixed blocks had the largest areas predicted to flood by FEMA, Latinx and Mixed Blocks experienced the greatest amount of flooding by building percentage outside of the FEMA prediction. Areas outside of the FEMA prediction zone were less prepared for flooding than those within the FEMA prediction zone.

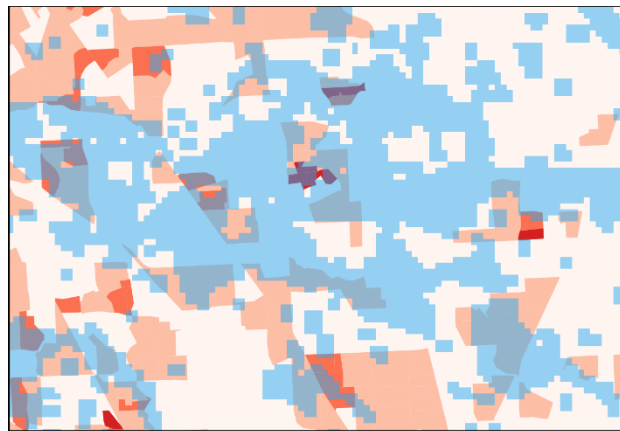
Table 1: Percent Flooded Building Area in and not in FEMA Flood Zone by Majority Racial/Ethnic Group

Majority Group	Block Groups (count)	Percent Flooded Building Area & in FEMA flood zone	Percent Flooded Building Area & not in FEMA flood zone
Asian	3	0	15.72
Black	175	7.13	14.76
Latinx	643	8.24	21.93
White	459	7.37	18.14
Mixed	864	5.27	23.70

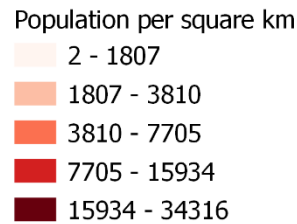
Racial/Ethnic Composition of Particularly Populated Flooded Areas



Submap 2



Submap 1



Submap 3

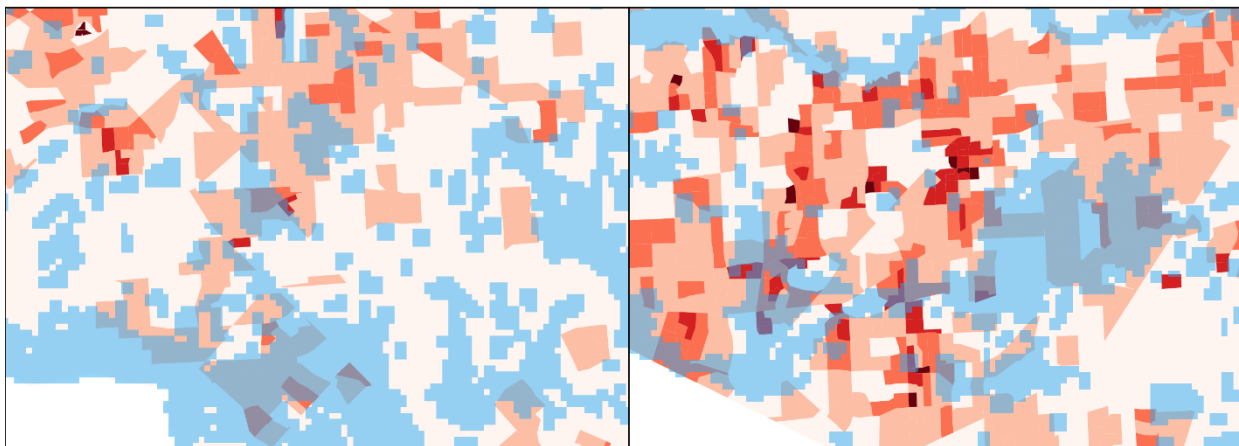


Figure 3: Race/Ethnicity by Block and Flood Overlaying Population Density by Block

Figure 2 shows three highlighted areas where clusters of high population density blocks were affected most by the flood. These areas were generally areas with mixed demographics or were predominantly Latinx. While many white areas along the outer reaches of Harris County were affected by high levels of flooding, population densities were not high there.

Exposure to Toxic Releases by Majority Racial/Ethnic Group

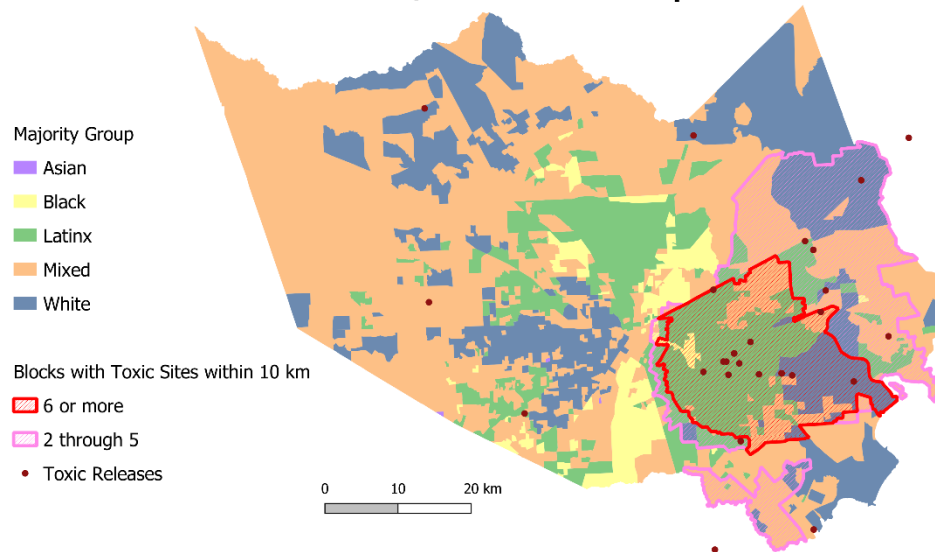


Figure 4: Exposure to Toxic Releases by Race/Ethnicity

Figures 4 and 5 show the differences by race/ethnicity in exposure to toxic releases. Hurricane Harvey's flooding caused numerous releases of pollutants into the surrounding environment. While toxic releases were generally clustered around the Eastern side of the city, they were most prevalent in mass in blocks with Latinx majorities. While percentages of all other racial/ethnic groups decrease with proximity to toxic sites, Latinx percentages increase. Protection around toxic sites may have been less regulated in regions with Latinx majority, causing a greater number of releases in those locations. A difference in level of preparations for flooding based on racial majority would constitute bias in Harris County's planning.

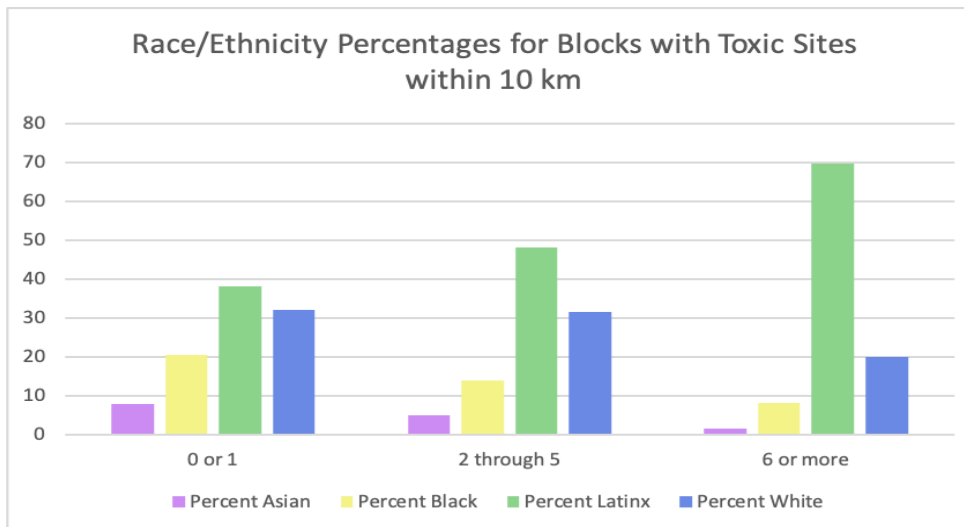


Figure 5: Racial/Ethnic population percentage by Exposure to Toxic Releases.

Data Sources:

Data of Block groups and Block group demographics:

Source: United States Census API <https://www.census.gov/developers/> via R tidycensus
<https://walkerke.github.io/tidycensus>

Toxic Releases Locations:

Source: Environmental Integrity Project via public reports and U.S. Coast Guard National Response Center data <https://environmentalintegrity.org/news/harvey-map/>

Hurricane Harvey Actual Flooding:

Sources: The Flood Observatory <https://floodobservatory.colorado.edu/> and the Harris County Flood Control District: <https://www.hcfcfd.org/Hurricane-Harvey>

Buildings in Harris Country:

Sources: The layer was rasterized by Derrick Burt (January 2023) from a shapefile of 2018 Texas buildings retrieved from the following ArcGIS Rest Feature Service:
<https://www.arcgis.com/home/item.html?id=2f3cfc9e544a4485a6cbbf0d721c0a2c>

FEMA 100-year flood zone map:

Sources: The layer was rasterized by Derrick Burt (October 2022) from a shapefile of FEMA 100-year flood zones in Harris County, TX. The original layer was retrieved from FEMA's National Flood Hazard Layer (NFHL) Viewer:
<https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd>